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A large new species of *Sylvisorex* (Mammalia: Soricidae) from Nigeria and the first record of *Sylvisorex ollula* from the country

Rainer Hutterer & Christian Montermann
Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany

Abstract. A new species of shrew, *Sylvisorex corbeti* n. sp., is described from SE Nigeria. The only specimen known was previously assigned to *Sylvisorex ollula*, but is considerably larger, has a longer tail, elongated hindfeet and a very large skull and thus represents the largest species of the genus. From the Obudu Mountains in SE Nigeria a new specimen is recorded which agrees well with typical *S. ollula* from lowland forest of southern Cameroon, and which represents the first species record from Nigeria.

Key words. Africa, Nigeria, Mambilla Plateau, *Sylvisorex*, new species.

1. INTRODUCTION

The shrews of Nigeria were reviewed by Hutterer & Happold (1983) who recorded 23 species in three genera, including *Sylvisorex* Thomas, 1904, at that time known from the country only by *Sylvisorex megalura* (Jentink, 1888), a species sometimes included in the genus *Suncus* Ehrenberg, 1832 (Hutterer 2005). Hutterer et al. (1992) added three further species from mountain forests in SE Nigeria, *Sylvisorex camerunensis* Heim de Balsac, 1968, *Sylvisorex ollula* Thomas, 1913, and *Crocidura attila* Dollman, 1915. *Sylvisorex ollula* is the largest of the 14 species of the genus known so far (Hutterer 2005; Hutterer et al. 2009; Mukinzi et al. 2009). It was described from lowland forest near the River Ja in SE Cameroon (Thomas 1904) and is known also from Gabon (Brosset 1988; Goodman & Hutterer 2004), Equatorial Guinea (Lasso et al. 1996), Central African Republic (Ray & Hutterer 1996), Republic of Congo (Querouil et al. 2003), and Democratic Republic of Congo (Dieterlen & Heim de Balsac 1979). Records from Cameroon are rare and concentrated in the south of the country (Heim de Balsac 1968; Goodman et al. 2001). To the west, the species is known from around Mount Cameroon (Heim de Balsac 1959, 1968) and from the Korup National Park (Hutterer & Schlitter 1996). The record from SE Nigeria therefore appears to be isolated. However, more specimens have become available in recent years, both from Cameroon and Nigeria, and we are now in a position to re-evaluate the systematics of the populations at the northwestern edge of the range of the *S. ollula* group.

2. MATERIAL AND METHODS

We studied new material from Nigeria and Cameroon obtained by G. Nikolaus and M. Barej from 1992 to 2006 (see below). These specimens are deposited in the Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK); other material studied is deposited in the Estacion Biologico Donana, Sevilla (CET) and the Natural History Museum, London (BMNH). Skull measurements were taken with an electronic calliper. All measurements are given in millimetres (mm), and body mass in grams (g). The terminology of cranial and dental structures follows Meester (1963) and Jenkins (1984); external and cranial measurements are the same as previously defined by Stanley et al. (2005) and Kerbis Peterhans et al. (2008). The terminology of the skeletal elements of the limbs follows Woodman & Morgan (2005). Digital X-rays were made with a Faxitron LX60 machine. The taxonomy of shrews follows Hutterer (2005), except for the unsettled allocation of *Suncus megalura*. For the purpose of this paper we include *S. megalura* in the genus *Sylvisorex*.

Comparative material of *S. ollula*. Cameroon: ZFMK 63.190, camp V, above Mueli, northern side of Mount Cameroon, 600 m; ZFMK 63.533, Nyasoso, N Mount Cameroon; ZFMK 99.683, E Nkongsamba, Mount Nlonako, camp near Nguengue, 1200 m, cloud forest; ZFMK 2008.220, Cameroon, Reg. Mamfe, Mukwecha/ Araebisu, 165 m; ZFMK 2008.226, SE Cameroon, Campo Region, Nkoelon, 75 m. Gabon: Equatorial Guinea: CET 736,

Monte Alen (LASSO et al. 1996); Nigeria: ZFMK 95.70, SW Obudu Mountains, Boje Forest (06.15 N, 08.55 E), 290 m.

Fig. 1. Flat study skins of a *Sylvisorex ollula* (ZFMK 95.70) from Nigeria and of the holotype of *Sylvisorex corbeti* n. sp. (ZFMK 88.91). Natural size.

3. RESULTS

3.1. A large forest shrew from Nigeria

***Sylvisorex corbeti* n. sp.** (Figs 1, 2, 4, 5)

Holotype and type locality. Skin mounted on cardboard and skull of a young adult female (ZFMK 88.91), collected by G. Nikolaus on 23.03.1988 (field no. GN 60) in forest swamp near Chappa Waddi, (07° 01' N, 11° 41' E), 1 900 m a.s.l., Gotel Mountains, SE Nigeria. The sex of the specimen was previously given as "male" by HUTTERER et al. (1992), but the collector determined it as female.

Measurements of holotype. Body mass 30 g, head and body length 100 mm, tail 64 mm, hindfoot length 17 mm without and 19 mm including claws, ear conch 10 mm.

Diagnosis. A very large and dark blackish brown species of *Sylvisorex* with a total length of 164 mm. Tail of medium length (64 % of head and body length), with no long bristle hairs. Hindfoot long and narrow, metacarpals and metatarsals elongated. Skull large and robust, with a long and wide inter-orbital region, a broad infra-orbital bridge, and a long toothrow. Upper P4 with a large parastyl.

Description. *Sylvisorex corbeti* n. sp. is the largest species of the genus. The head is large, as compared to *S. ollula* (Fig. 1). The colour of the fur is uniformly blackish brown. The hair bases on the dorsum are plumbeous, and the tips blackish brown. No difference in colour exists between dorsum, venter, and limbs. Hairs on dorsum are about 3-4 mm in length. Facial vibrissae reach 27 mm in length. Ear conch has a medium size, is round and pocketed, and covered by very short hairs. Hind foot very long and narrow, with elongated digits and short claws (Fig. 2). Ventral inner surface of hind foot with folds but not covered by small granule-like bumps. Tail of medium length, colour uniform, no long bristle hairs present.

Skull (Fig. 4) very large with a large hexagonal braincase. Dorsal profile (Fig. 5) straight, rostrum long and robust. Interorbital constriction relatively broad (21.2 % of condylo-incisive length, versus 20.7 % in *S. ollula*), its outer margins running almost parallel. Infra-orbital bridge wide, lachrymal foramen large. Maxillary wide compared to *S. ollula*; zygomatic process of maxillary pointed. Superior and inferior articular facets large and robust. Anterior palate with three incisive foramina; one pair between the upper unicuspids, and a single one behind.

Upper teeth: First upper incisor very large, with a long anterior hook and a less prominent talon (Fig. 5). First upper unicuspid very large, second, third and fourth unicuspids much smaller, the third being a little larger than the

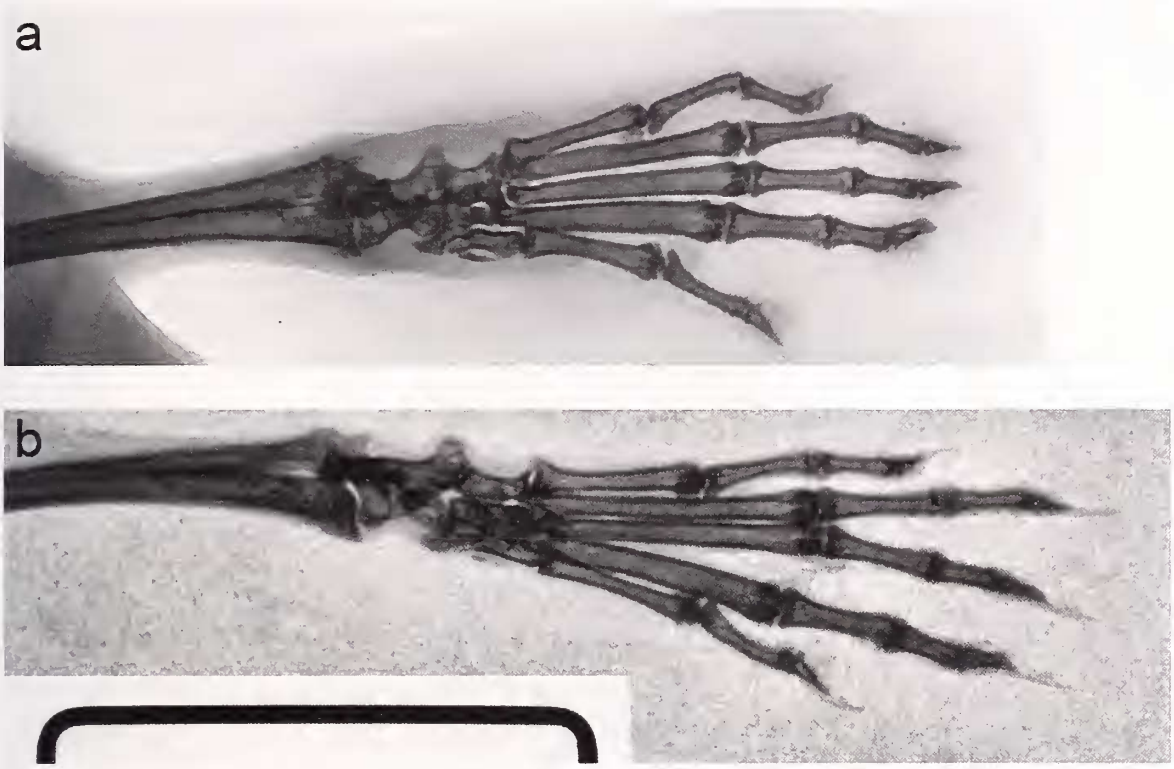

Fig. 2. X-rays of a hindfoot of *Sylvisorex ollula* (ZFMK 2008.226, top) and of *Sylvisorex corbeti* n. sp., (holotype ZFMK 88.91, bottom); scale is 12.8 mm. Note the difference in length of the metacarpals.

Table 1. External measurements (mm) and weight (g) of *Sylvisorex corbeti* n. sp. and of some *S. ollula* from Nigeria and Cameroon.

Species	Origin	TL	HB	Tail	HF	E	WT	Tail/HB
S. corbeti n. sp., ZFMK 88.91	Nigeria	164	100	64	17/19	10	30	64 %
S. ollula, ZFMK 95.70	Nigeria	142	90	52	14/15	8	17	58 %
S. ollula, ZFMK 63.190	NW Cameroon	142	92	50	14/16	8	19	54 %
S. ollula, ZFMK 69.533	NW Cameroon	141	84	57	15/17	8	20	68 %
S. ollula, ZFMK 99.683	NW Cameroon	131	84	47	14/16	8	21	56 %
S. ollula, ZFMK 2008.220	NW Cameroon	141	88	53	14/15	8	16	60 %
S. ollula, ZFMK 2008.226	SE Cameroon	139	83	56	16/17	8	16	67 %

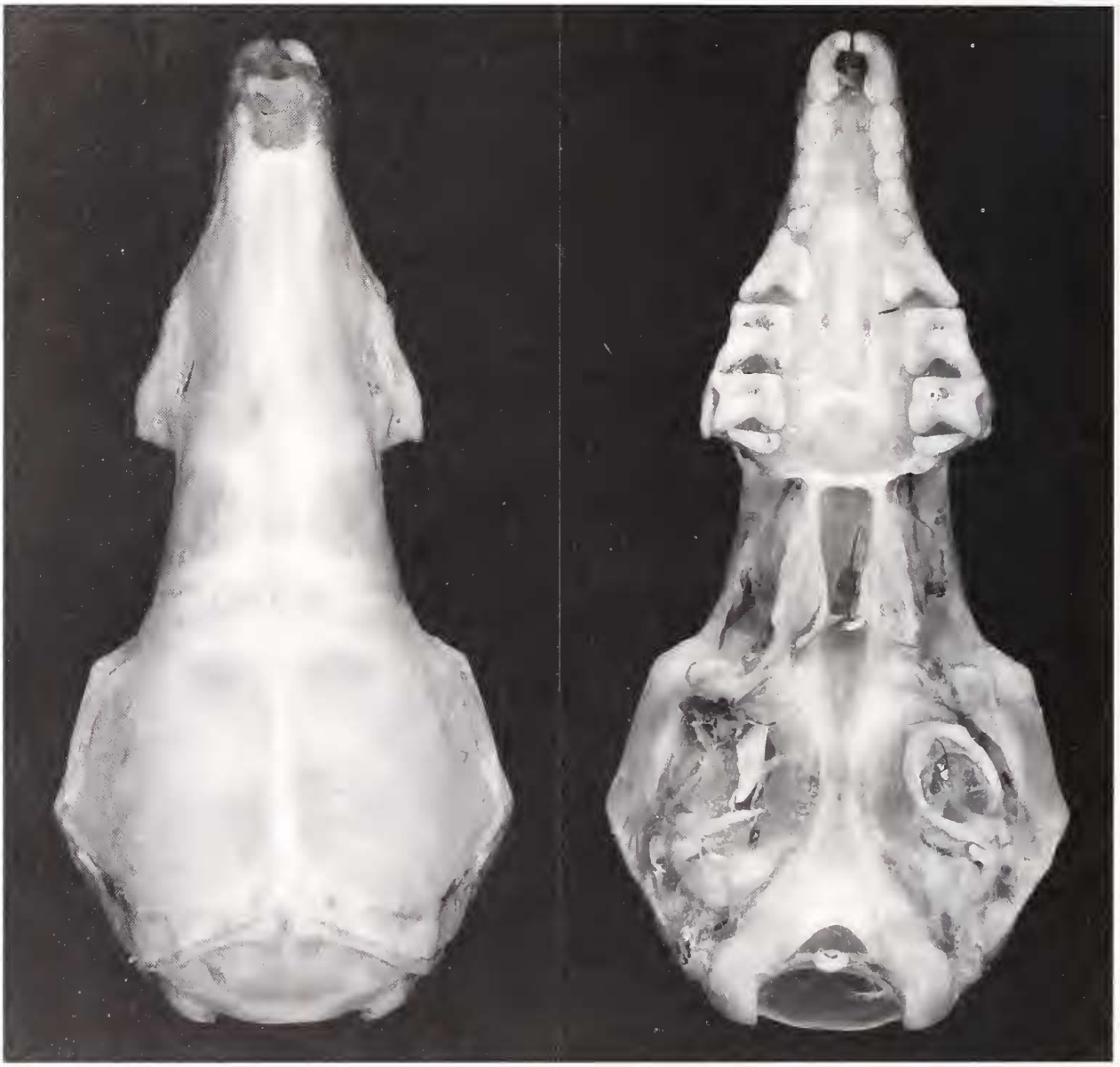

Fig. 3. Skull of *Sylvisorex ollula* (CET 736) from Equatorial Guinea in dorsal and ventral view. Total length of skull 24.62 mm.

second and fourth. P4 large, with a prominent parastyle and a large paracone (or metacone, according to MEESTER 1963). The talon of P4 is longer than in *S. ollula*, extending closer to M1 than in *S.ollula*. M1-2 are large and square-shaped in occlusal view, M3 is short (0. 69 x 1.56 mm in the holotype), but not as reduced as in *S. ollula* (Fig. 4).

Mandible: Robust with a long ramus, a low coronoid process, and a wide angular process. COR 54.7 % of LTR (59.6 % in *S. ollula*). Foramen mentale below posterior root of lower p4. Condyle robust and rectangular, about as wide as high.

Lower teeth: Tip of first incisor curved upwards, with two denticulations on cutting blade. Lower p4 as long as wide (occlusal view). Lower molars long and slender in occlusal view; third lower molar without talonid basin.

Comparisons. *S. corbeti* n. sp. is larger than any other species in the genus, as understood here. It can only be compared with *S. ollula*, which it resembles externally. In absolute external measurements, *S. corbeti* n. sp. is larger and has a longer tail than specimens of *S. ollula* from Nigeria or Cameroon (Table 1), although the relative tail length is similar. Specimens from Gabon and Equatorial Guinea (GOODMAN & HUTTERER 2004, LASSO et al. 1996)

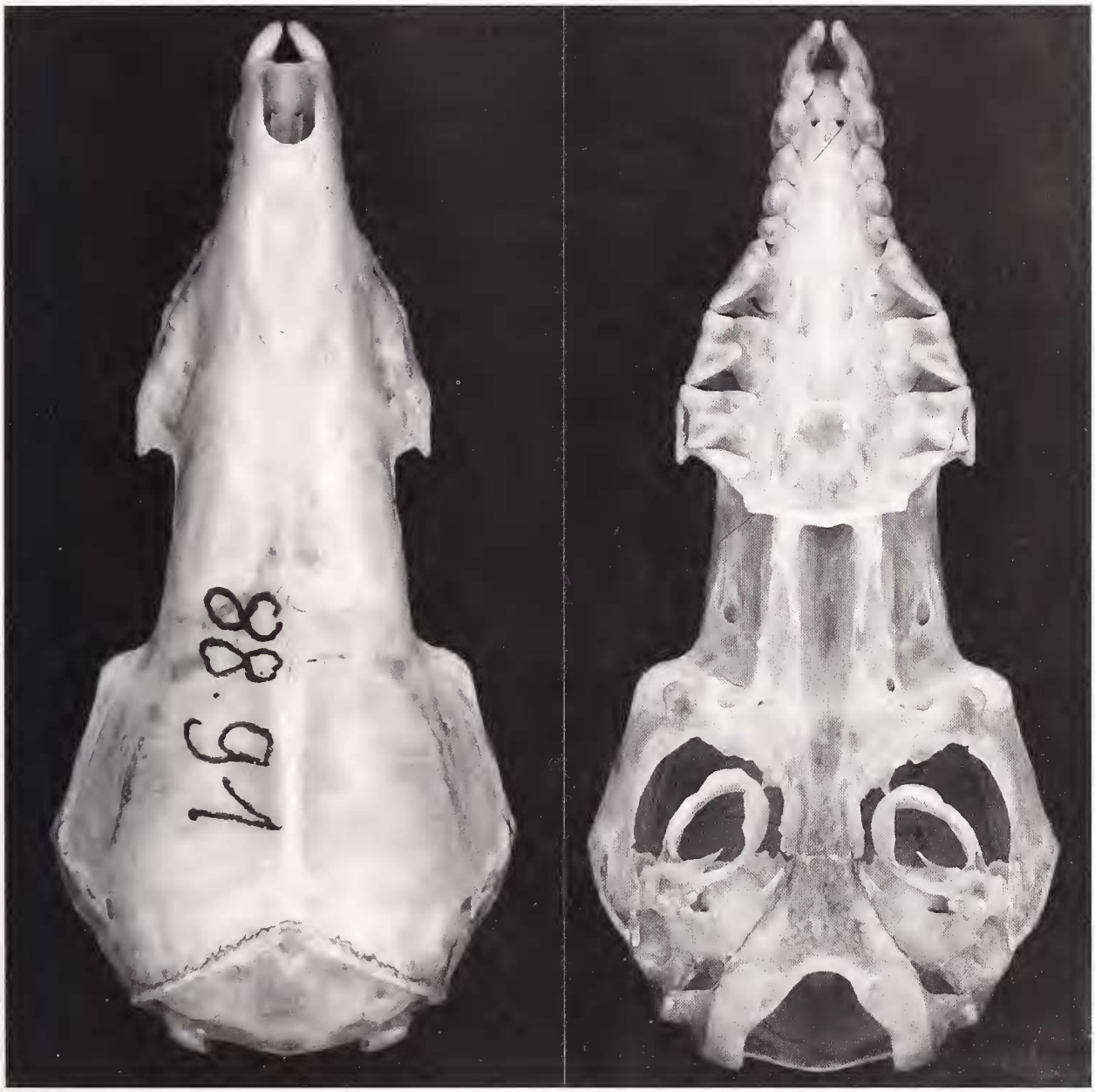

Fig. 4. Skull of *Sylvisorex corbeti* n.sp. (holotype ZFMK 88.91) from SE Nigeria. Total length of skull 26.48 mm.

are smaller also. The fore- and hindfeet of the new species are also considerably longer, due to a prolongation of skeletal elements such as metacarpals and metatarsals (Fig. 6).

The skull of the holotype of *S. ollula* (THOMAS 1913) was figured by JENKINS (1984), and another specimen from Equatorial Guinea is shown in Fig. 3. *S. corbeti* n. sp. (Figs 4, 5) is distinguished by size (Table 2), but also by a number of cranial and dental details mentioned above. The largest fossil species, *S. olduvaiensis* Butler & Greenwood, 1979, is considerably smaller (BUTLER & GREENWOOD 1979); it has a mean coronoid height of 4.5 mm (5.94 mm in the new species).

Habitat. The holotype was collected in a forest swamp at 1900 m. It shares this habitat with rodents such as *Otomys occidentalis* Dieterlen &Van der Straeten, 1992 and *Praomys obscurus* Hutterer & Dieterlen, 1992.

Etymology. We dedicate this species to Gordon B. Corbet, former curator of mammals at The Natural History

Museum, London. He has served the scientific community for decades by hosting visitors from all around the world at the British Museum mammal collections. Besides writing textbooks on mammals of the Palaearctic and Indomalayan Regions and the World, he has demonstrated his interest in African mammals by careful revisions of hedgehogs, hyraxes, and elephant shrews. He also described the now probably extinct Nigerian pygmy hippopotamus (CORBET 1969).

3.2. A new record of *Sylvisorex ollula* from Nigeria

The presumed record of *S. ollula* from Nigeria (HUTTERER et al. 1992) is no longer valid, after our study revealed that the voucher specimen represents a different species described here as new. However, *Sylvisorex ollula* does occur in Nigeria, as a new yet unrecorded specimen demonstrates. During a survey of small mammals of the Boje Forest at 290 m in the SW Obudu Mountains (06.15 N, 08.55 E), G. Nikolaus collected a male of *S. ollula* on 13 January 1995. The specimen (ZFMK 95.70, Fig. 5) is much smaller than *S. corbeti* n. sp. and agrees well with typical *S. ollula* in size (Table 1) and shape of skull (Fig. 5).

4. DISCUSSION

The discovery of *Sylvisorex corbeti* n. sp. further enriches the morphological diversity of the genus, as previously summarized by HUTTERER (1985) and HUTTERER & SCHLITTER (1996). With a body mass of 30 g it marks the upper limit of the genus. The new species shows a unique combination of characters of a terrestrial forest shrew (large body, tail of medium length, ear conch of moderate size) with those of scansorial shrews (elongated limbs). The digits of the hindfoot (expressed by the length of metatarsal III) are even longer than in *Sylvisorex megalura* (Fig. 6), a species known for its adaptation for climbing (VOGEL 1974). We know nothing about the lifestyle of the new species, except that it lives in forest swamp at 1900 m. It is part of a guild of small mammal species confined to the forested parts of the Mambilla Plateau shared by Nigeria and Cameroon (HUTTERER et al. 1992).

The true content of the genus *Sylvisorex* is still not known. New species with surprising adaptations have been discovered in Central Africa (MUKINZI et al. 2009; HUTTERER et al. 2009) and add to the diversity of the genus. We included two further undescribed species from D. R. Congo in Fig. 6, to be described in the future. If these and others are included, the number of species of *Sylvisorex* is close to 20. Genetic studies suggest that *S. megalura* may be related to *Suncus* (QUEROUIL et al. 2001),

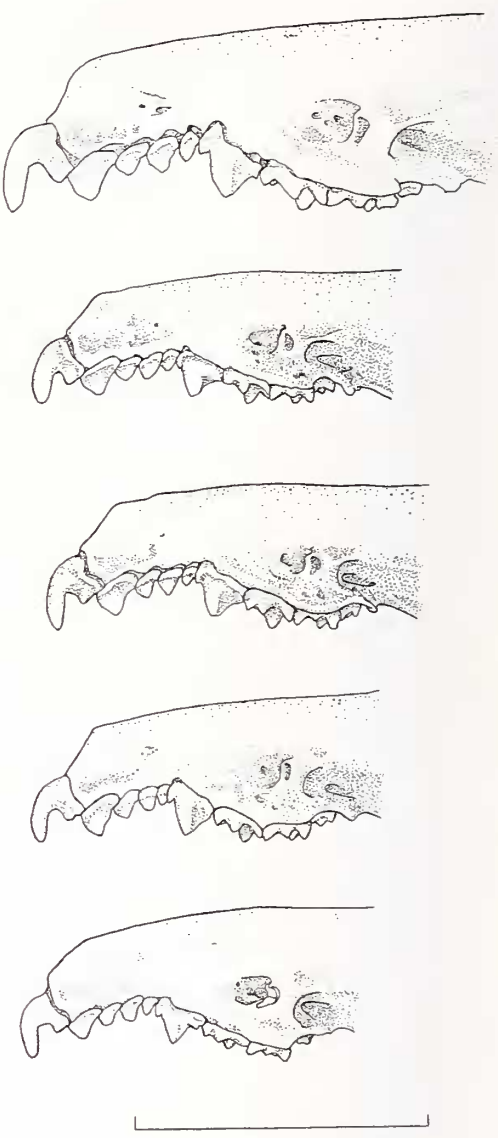

Fig. 5. Lateral views of the maxillary portion of the skulls of (top to bottom) *Sylvisorex corbeti* n. sp. (holotype) and *S.ollula* (ZFMK 95.70. SE Nigeria), ZFMK 69.533 (NW Cameroon), ZFMK 2008.220 (NW Cameroon), and CET 736 (Equatorial Guinea). Scale 10 mm.

and other authors (DUBEY at al. 2008) propose the inclusion of all African *Suncus* and *Sylvisorex* species into one genus. A paraphyly of *Sylvisorex* was already considered by HEIM DE BALSAC & LAMOTTE (1957). Further problems are posed by the morphologically unique genera *Ruwenzorisorex* Hutterer, 1986 and *Scutisorex* Thomas, 1913, both of which are genetically close to *Sylvisorex*. No conclusive phylogeny is available at this moment, but the study of African forest shrews remains an exciting enterprise.

Table 2. Cranio-dental measurements of *Sylvisorex corbeti* n. sp. and *S. ollula* from Nigeria and Cameroon.

Species	CI	PL	UTR	P4-M3	IO	MB	GW	PGL	HCC	LTR	COR
S. corbeti n. sp. ZFMK 88.91	26.48	11.59	11.47	6.18	5.61	7.63	11.94	8.13	6.18	10.86	5.94
S. ollula, SE Nigeria ZFMK 95.70	24.26	10.37	10.47	5.61	4.86	7.26	11.02	7.40	5.98	9.84	5.96
S. ollula, NW Cameroon ZFMK 63.190	24.79	10.43	10.76	5.88	5.34	7.60	11.14	7.67	6.19	10.19	6.28
S. ollula, NW Cameroon ZFMK 69.533	24.75	10.61	10.89	5.80	4.98	7.44	–	7.54	5.99	10.32	5.96
S. ollula, NW Cameroon ZFMK 99.683	25.28	11.28	11.01	5.80	4.97	7.17	11.18	7.72	6.21	10.35	5.92
S. ollula, NW Cameroon ZFMK 2008.220	24.10	10.20	10.83	5.97	5.17	7.46	11.36	7.61	5.85	10.76	6.42
S. ollula, SE Cameroon ZFMK 2008.226	24.48	9.73	10.87	5.87	5.16	7.30	11.15	7.46	6.17	10.45	5.97
S. ollula, Equ. Guinea CET 736	24.62	10.40	10.39	5.69	5.14	7.28	11.49	7.66	6.33	9.86	6.21

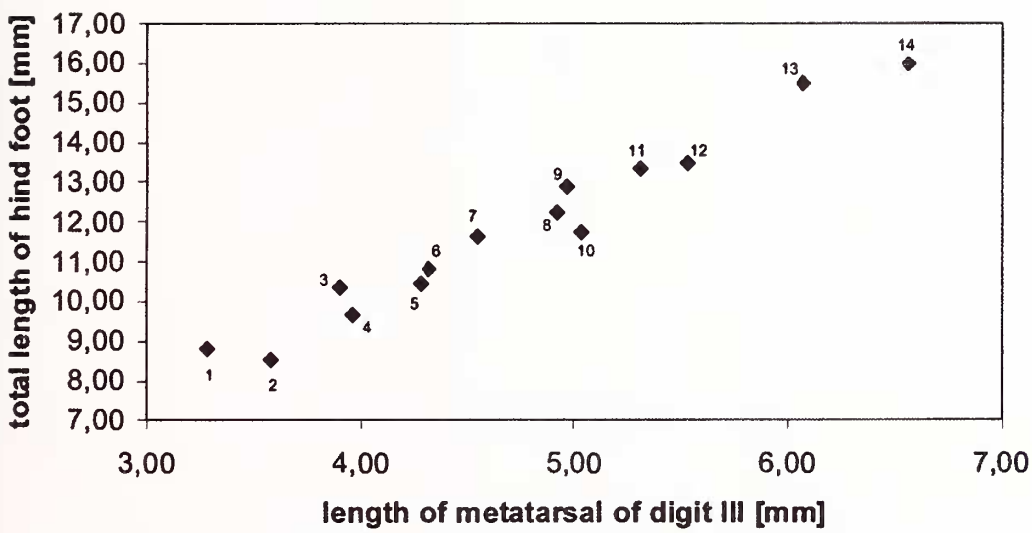

Fig. 6. Relation between length of the metatarsal of digit III and total length of hind foot, as taken from digital X-ray images. 1 *S. akaibei* Mukinzi, Hutterer & Barriere, 2009, 2 *S. johnstoni* (Dobson, 1888), 3 *S. konganensis* Ray & Hutterer, 1996, 4 *S. vulcanorum* Hutterer & Verheyen, 1985, 5 *S. granti* Thomas, 1907, 6 *S.* n. sp. A, 7 *S. morio* (Gray, 1862), 8 *S. camerunensis* Heim de Balsac, 1968, 9 *S. lunaris* Thomas, 1906, 10 *S. isabellae* Heim de Balsae, 1968, 11 *S. ollula*, 12 *S.* n. sp. B, 13 *S. megalura*, 14 *S. corbeti* n. sp.

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Zusammenfassung. Aus dem südöstliehen Hochland von Nigeria wird eine neue Spitzmausart als *Sylvisorex corbeti* n. sp. besehrieben. Das der Beschreibung zu Grunde liegende Tier war zuvor als *Sylvisorex ollula* bestimmt worden, ist aber deutlich größer, besitzt einen längeren Schwanz, verlängerte Hinterfüße und einen sehr großen Sehädel und repräsentiert damit die größte Art der Gattung. Ein neues Exemplar aus den Obudu Mountains im südöstlichen Nigeria stimmt morphologiseh gut mit typischen *S. ollula* aus den Tieflandregenwäldern des südliehen

Kamerun überein and repräsentiert daher den ersten korrekten Nachweis dieser Art für Nigeria.

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Authors' addresses: Dr. Rainer HUTTERER, Zoologisches Forschungsmuseum Alexander Koenig, Section of Mammals, Adenauerallee 160, D-53113 Bonn, Germany. e-mail: r.hutterer.zfmk@uni-bonn.de; Dipl.Biol. Christian MONTERMANN, Brantestrasse 6, D-56746 Hohenleimbach, Germany.

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